



Technical Note OM-MS-1.10

Condition Rating Procedures for Concrete in Gravity Dams, Retaining Walls, and Spillways

Purpose

The purpose of this technical note is to provide information about the REMR Management System for concrete gravity dam, retaining wall, and spillway monoliths.

Background

The U.S. Army Corps of Engineers operates approximately 270 navigation dams, usually with accompanying attachments and appurtenances, constructed of plain or reinforced concrete. The Corps also operates more than 350 reservoir dams, most of which are either concrete gravity structures or embankment structures with accompanying attachments and appurtenances constructed of plain or reinforced concrete. Many of these structures require or will require significant repairs to ensure safe and efficient operations. A quantitative rating system for the condition of concrete in gravity dams and attachments and appurtenances has been developed and is described in a REMR technical report (Bullock and Foltz 1995). This rating system provides objective information to aid in making the decision of which dam, which structural unit within a dam, and which deficiency within a structural unit most merit repair. A computer application, CONCDAM, employs this condition rating system to provide a decision support tool to managers who plan REMR activities for concrete gravity dams.

REMR Management Systems

Procedures have been developed under the REMR Research Program for performing condition surveys, consistent and quantitative condition assessment, and database management. Collectively, these procedures are part of the REMR Management Systems (*The REMR Notebook* 1991). Use of the REMR Management Systems reduces dependence on many of the subjective elements in the decision-making process from maintenance and repair (M&R) planning. CONCDAM is a component system of the REMR Management System. Other component systems address the REMR aspects of the lock gates, dam gates, steel sheet pile, etc.

The CONCDAM Program

A component system of the REMR Management System is CONCDAM. This microcomputer-based application addresses the REMR aspects of concrete gravity dam monoliths by performing database administration, calculations, and report generation. The following are fundamental pieces of CONCDAM:

- a. *User interface.* CONCDAM runs in an 386 compatible, DOS environment, and requires 640K free RAM. The user interface is menu driven, allowing even personal computer novices to use the program easily. Condition assessment data are entered into the program just as they were entered into the inspection form in the field. The user fills in the blanks or checks the appropriate response when prompted by the program.
- b. *Inventory.* CONCDAM houses an inventory of all waterway systems and dam structures within any given District. Data pertinent to each structure, such as owner/operator, construction date, dimensions, etc., inspection data, and condition-index (CI) ratings are stored.
- c. *Condition assessment.* The condition inspection data are gathered by visual observation and performance of simple measurements. The inspector catalogs the location and extent of concrete cracking, loss of volume, and deterioration. Other forms of distress such as exposed steel, leaks, stains, deposits, and missing or damaged armor are noted. The data are accepted and stored by CONCDAM, which uses an algorithm to produce a CI (Bullock and Foltz 1995) for each monolith inspected. The CI represents the condition of the concrete in each monolith on a scale of 0 to 100, with 100 reflecting an "as built" condition. A CI under 40 indicates a "poor" condition. Great care was taken in the development of the algorithm and inspection procedure to ensure that the results are consistent and repeatable. It is such uniformity that allows an objective comparison of the condition of concrete in one structure to that of another.

Future Developments

The collection of consistent, uniform condition assessment data will allow the generation of typical curves reflecting rates of deterioration. The combination of historical condition data and expert opinion should allow prediction of changes in the CI based on maintenance history, operating conditions, and applied M&R policies.

References

Bullock, R.E., Foltz, S., June 1995, "Condition Rating Procedures for Concrete in Gravity Dams, Retaining Walls, and Spillways," Technical Report REMR-OM-16, U.S. Army Construction Engineering Research Laboratory, Champaign, IL.

The REMR Notebook. (1991). "REMR Management Systems for Civil Works Structures," REMR Technical Note OM-MS-1.1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.